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Analysis and Aspects of Art as an Alternative Investment and its Price Determinants

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ABSTRACT

The purpose of this thesis is to examine the potential of art as an alternative investment. To do this, we start with a brief history of art market that is followed by an analysis of art market structure. We cover numerous risks affecting the behavior in the market subject to information asymmetry. As far as the feasibility of art as an investment is concerned, we identify different types of alternative investment and compare their potential. Despite high opacity of the art market, more data are being made available giving us an opportunity to present a clearer explanation of the current state of the art market. A question has to be asked, does the value of art solely depend on the subjectivity of human taste or on an opportunity to speculate? The subject of the detailed discussion are, both, internal and external factors, which influence the value of artworks, and hence the sale price. Using econometric analysis of auction records, we aim to uncover objective factors, which determine the sale price. The analyses lead to a conclusion that the price determinants, the most notable of which are auction houses and auction location, affect the sale price to a different extent. Yet, regardless the price, our subjective personal pleasure from a particular art piece might be crucial.

JEL Classification A22, C25, D44, F23, M20, Z10, Z11

Key words art market, artwork, auctions, price, price determinants, value, artists

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ABSTRAKT

V tejto bakalárskej práci skúmame potenciál umenia ako alternatívnej investície. Na začiatku sa v krátkosti venujeme histórii trhu s umením, po ktorom nasleduje presná analýza štruktúry umeleckých trhov. Zaoberáme sa rizikami, ktoré ovplyvňujú správanie na trhoch podliehajúcim informačnej asymetrii. Potenciál umenia ako investície porovnávame s ďalšími alternatívnymi formami, ktorými sú zlato a víno. Napriek veľkej neprehľadnosti umeleckých trhov, sa stále väčší počet dát sprístupňuje širokej verejnosti, vďaka ktorým môžeme prezentovať o niečo jasnejší pohľad na súčasný stav trhu s umením. Postupne nás k diskusia vedie k zásadnej otázke, závisí hodnota umenia výhradne na subjektívnych ľudských preferenciách a na špekuláciách? Detailne rozoberáme interné aj externé faktory vplývajúce na hodnotu umenia, a následne aj na jeho cenu. Snahou ekonometrickej analýzy aukčných výsledkov je odhaliť objektívne cenové determinanty umeleckých diel. Výsledky ukazujú, že každý z cenových determinantov, z ktorých najvýraznejšie sú aukčný dom a miesto aukcie, ovplyvňuje predajnú cenu umenia do inej miery. Osobné preferencie a subjektívna radosť z diela majú veľakrát, bez ohľadu na cenu, zásadný vplyv na hodnotu umenia.

Klasifikácia JEL	A22, C25, D44, F23, M20, Z10, Z11
Kľúčové slová	trh s umením, umelecké dielo, aukcie, cena, cenové determinanty, hodnota, umelci
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Prague, July 18, 2018

Alica Mozolíková

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ACRONYMS

AE	Auction Estimates
APT	Arbitrage Pricing Theory
BASI	Blouin Art Sales Index
BLUE	Best Linear Unbiased Estimator
CF	Cash Flow
EMH	Efficient Market Hypothesis
FDI	Foreign Direct Investment
FMV	Fair Market Value
GDP	Gross Domestic Product
HAC	Heteroscedasticity – consistent standard errors
IGW	Investment Grade Wine
MCV	Marketable Cash Value
MLR	Multiple Linear Regression
OLS	Ordinary Least Squares
RRV	Retail Replacement Value
SE	Standard Errors
SWAG	Silver, wine, art and gold assets
USD	United States Dollar
VIF	Variance Inflation Factor

BACHELOR THESIS PROPOSAL

Author	Alica Mozolíková
Supervisor	doc. Ing. Vladimír Benáček CSc.
Proposed topic	Analysis and Aspects of Art as an Alternative Investment and its Price Determinants

Topic Characteristics On 15th November 2017 at Evening Sale at Christie's in New York the most expensive art piece ever was sold. The price including buyer's premium for Leonardo da Vinci's *'Salvator Mundi'* totaled at USD 450,321,500. Art by its nature is a very unusual investment strategy subject to information asymmetry, market opacity and uncertainty. Liquidity of artworks is usually low. In contrast, this investment of passion presents very high profits. A question needs to be asked, whether there are any general art value determinants, which are objectively represented in the sale price? Thus, the aim of this thesis is to provide clearer picture of the current state of the art market, to analyse the art value determinants and their effect on the sale price at auctions, providing information about the strength of art as an alternative investment.

Hypotheses

Hypothesis #1: Auction houses located in notable art centers (London, New York, and Hong Kong) have a positive effect on formation of the sale price.

Hypothesis #2: Having the artwork auctioned in Sotheby's or Christie's increases the value, and hence the sale price.

Hypothesis #3: Signed artworks achieve better appreciation in the sale price than art pieces with missing signature.

Methodology Important part of this thesis focuses on detecting the art value determinants, which influence the sale price. Econometric analysis of the art value determinants influencing the sale price uses a model in which the sales data from small to large auction houses (Sotheby's and Christie's) are processed with application of BlouinArtSalesIndex results. Standard econometric models are used to test the proposed hypothesis.

Outline

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Chapter 1

INTRODUCTION

"The exponential increase in the amount of data created by human societies is a basic fact of our time. There is no type of information – documents, books, images video – that is declining. But in addition, we also create more material goods each year than the previous one. Today we are awash in cheaply produced objects to a degree that would have been hard to imagine a century ago. The result, arguably, has been a shift in the ratio of importance between making new objects and choosing what is already there."

(Obrist, 2014, p.23-24)

Undeniably, the sophistication and glamour imparted by art are one of a kind. In recent years, much attention has been given to art as an alternative investment. The high profit potential as well as the academic curiosity have fueled a search for objective price determinates, which would bring more transparency into valuation of artworks. Art market is one of the last surviving unregulated international markets, and the prices paid for art since the late 1980s are the highest ever (Robertson, 2005).

The market in visual arts is dominated by duopoly of Christie's, a privately owned company and Sotheby's, a publicly listed institution, taking ¾ of the market (Markopoulioti, 2017). A major auction record was achieved in 2015 for "Women of Algiers" by Pablo Picasso sold at Christie's New York for $179,364,992 million. It was a second successful sale of the work in less than 20 years, during which the painting has appreciated by almost 600%. This record was broken in 2017, again, at Christie's New York when it sold "Salvator Mundi" by Leonardo da Vinci for astonishing $450,312,500 million. In 2017 the total value of auction market was $14,9 billion.

Accordingly, art follows money and it is always crucial to be aware of local financial trends but wealthy economy does not guarantee established and well behaved art market. For instance, Switzerland despite its highly regarded economic status belongs to category of emerging art markets with developing infrastructure. Thus, it is essential

to provide a brief history and a clear structure of the art market, which are described in Chapter 2, followed by a discussion of numerous risks present in the art market, e.g. extreme heterogeneity of its products and their low liquidity. Consequently, Chapter 3 offers a motivation for considering art as an asset by comparing its potential with other investments, namely wine, gold, stocks and private equity. In addition, it discusses art auctions and principles under which they operate. In Chapter 4, the fundamental research question considers different external and internal factors affecting the value of art, and hence its sale price. After describing the methodology used for testing hypothesis, we interpret and discuss the results of linear regression model. We also talk about limitations of our regression model and suggest extensions for further research. Chapter 5, Conclusion, assesses the hypothesis and summarizes our findings. Chapter 6, Bibliography, lists all the bibliography used in this paper in alphabetical order.

In this thesis, we examine three hypotheses. Firstly, we assume that auction houses located in notable art centers (London, New York, and Hong Kong) have a positive effect on formation of the sale price of auctioned art pieces. Secondly, we focus on prestige of auction houses and predict that having the artwork auctioned in Sotheby's or Christie's increases the value, and hence the sale price. Finally, we expect signed artworks to achieve better price appreciation than art pieces with missing signature.

In short, if art was considered solely for its investment purposes, its aesthetics and artistic qualities would be of no importance, only the financial appreciation would matter. This thesis proposes a better understanding of visual art market, and thereby unravels engaging aspects of its functioning. We aim to shed further light on art as an investment and its price determinants by exploring the value creation of artworks.

Chapter 2

ART MARKET

2.1 Brief History of Art Market

Art and money have a long history. The commercialization of art begun in 16th century in Antwerp where the center, both, for local and international art trade had emerged. At the time, the art market used to be very vibrant and fully focused on the potential of artist's reputation. In the 17th century, the art market was dominated by the Dutch country. Reportedly, up to 10 million works had been produced, but only one percent of them survived (Markopoulioti, 2017).

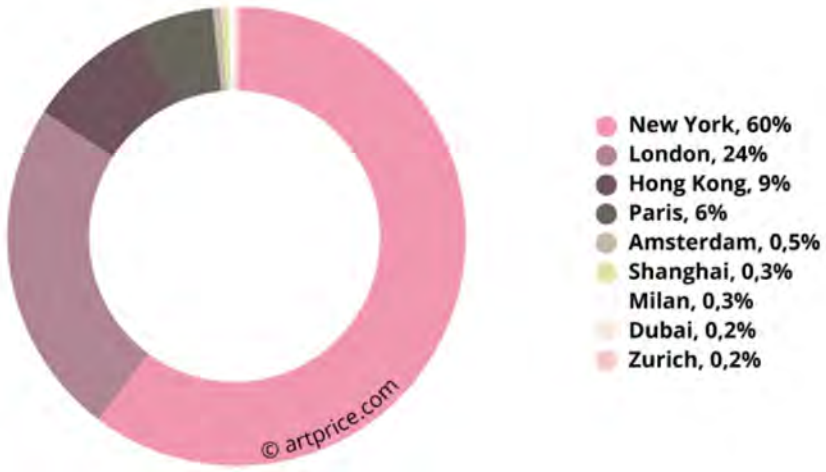
As a result of art commoditization, art dealing was becoming a legitimate business practice. By the mid 18th century Paris and London had gradually become the art business hubs. In 1784 Sotheby's opened its first store in London. Yet the French art market came to an end with the French revolution. In the late 19th century and early 20th century Impressionist art experienced a strong revival in Paris. The early to mid 20th century art market was affected by the World Wars. Despite the situation, impressionist artists were flourishing, selling artworks to clients in London, Paris and the US.

After WWII, Paris slowly fell out of the art market. In the early 1970s the British stock market crashed but the effect on the London Art Market was positive (Markopoulioti, 2017). In the 1980s and 1990s auction houses in Europe and in the US were expanding rapidly. Japanese buyers with an access to European and American art market have created with their aggressive buying of Impressionists art a market bubble. The bubble burst at the moment when Japanese government realized the money supply is not never-ending. Since then the market has been moving at much slower but steadier pace. Nowadays, New York and London together with Hong Kong are competing for the first place on the art market.

2.2 Defining Art Market

The art market is predominantly defined by auction houses and artists. Major international art market centers are New York, London and Hong Kong. This is very clear from Figure 2 that shows the art auction turnover for Christie's by city. Majority of the highest prices are achieved in New York and London but occasionally extreme prices for artworks are attained outside these two art market centers (Robertson, 2005).

Figure 2 Distribution of Christie's Fine Art Auction Turnover by City



Source: Artprice (2018)

To be more precise, New York puts emphasize on modern and contemporary art, while London on old masters and 19th century art. Hong Kong is a newcomer to the group, specializing in all Asian categories.

Consequently, emerging markets are affected, both, by global and local art scene. Lagos, Johannesburg, New Delhi, Istanbul, Tokyo, Shanghai, Tel Aviv, and Seoul are just a few of the emerging art centers with vibrant cultural infrastructure and state-backed institutions. Over the last decade, the art market has expanded by 72% (ArtPrice, 2018). Currently, the US represents 43% of the global art market and the UK

accounts for 22% (Markopoulioti, 2017). Artprice (2004) states that in 2003 the art market was represented by 59 countries compare to 34 countries 20 years ago, out of this Europe reported for 54% share. Market share for 2003 was as shown in Table 2 The major boom on the market happened in 2006, when it jumped from $32 billion to $47 billion. But in 2009 following the economic crash the art market fell by more than 40%, both, in value and in volume (Markopoulioti, 2017). In the following years it bounced back quickly. Around 18 million artworks were offered at auctions in 2012, with about 20% of lots not getting sold (Artnet, 2018). The estimated art market turnover in 2014 was $68 billion (Artprice, 2017). By the size of this figure, it is evident, the turnover size only reflects the sales recorded by the auction houses.

Table 2 The Global Art Market Share for 2003

	(%)
USA	42
UK	28
France	9
Italy	3.6
Germany	1.7
Netherlands	1.7
Australia	1.6
Switzerland	1.5
Sweden	1.3
Hong Kong	1.2
Others	6.8

Source: Artprice (2004)

The biggest issue of the art market has been its uncertainty and opacity. Old Masters represent the least volatile category with high level of consistency that counts only for 9% of the art market. Another very specific category with its still producing availability and large uncertainty in knowing how many pieces are yet to be produced is Contemporary Art, representing 46% of the art market. In contrast, Impressionist & Modern Art represents 32% of the art market (Markopoulioti, 2017).

2.3 Art Market Structure

Art market is divided into three basic categories: Primary Market for the first time sale of artworks, followed by Secondary Market represented by art fairs, art advisors and art dealers. Tertiary Market is solely for auction houses. The auction market, of course, follows a similar course to the overall art market. The categorization of the art market players used to be strict in the past, today multiple roles can be represented by one party. This change can easily be attributed to the effect of globalization that requires strong art networks to reflect the interests of the audience well. Within these networks, public institutions (e.g. the state, public galleries), which work as validation tools and exert strong financial effect on the market, represent 40% of the market in Asia, and around 30% in Europe and the US (Markopoulioti, 2017). Very popular are cross-continental museum partnerships.

2.4 Art Market Risks

Normal rules of supply and demand do not apply to art market. Plenty of transaction, which take place are not reported and auction houses only host a limited number of sales per year. For instance, a dealer never publishes all his sales, and hence not everyone can form an informed opinion. This is to say, the nature of the art market is very opaque. Insiders invest into art with a lot of inherent risk. As there is no legal authority to regulate the market it strongly depends on reputation and provides considerable level of flexibility.

Strictly speaking, art market is highly illiquid, one has to wait at least 3-6 months to be able to resell the particular piece (Markopoulioti, 2017). To satisfy the ever growing demand for Blue Chip[1] artworks, the amount of fake works has grown rapidly and the question of uniqueness has gotten under scrutiny. Markopoulioti (2017) explains that Blue Chip artworks provide their holders with prestige and social status. As an investment of passion, the willingness to pay is significantly higher but requires

[1] Blue Chip artworks refer to profitable art whose value, and hence the sale price is expected to hold or increase

extensive research that is time consuming. If, moreover, investors are focused in one geographic region, the whole art market is particularly sensitive to that region's economic environment. In this sense regional diversification is very important.

The most often cited problem on the art market is information asymmetry[2]. Poorly informed clients are facing a risk of buying a work of inferior quality. This means, the higher is the cost of a mistake, the higher is the willingness to pay for information. Meanwhile, art is considered to be a reliable asset because it is difficult to mass produce and there is no debt associated with the art market. But it has no unified valuation system, rather principles to which most experts adhere. The insurance costs together with storage and expert consultant fees are high. There are no particular geographical or political risks connected to art. It can be easily moved and insured against calamity risk. The tax duties on art are very favorable. One avoids the income tax liability during the holding period of an art piece. There are also several intrinsic risks linked to art objects; authenticity, legal title and condition. Any hesitation over the quality of particular work can lead to damaged reputation of dealer, gallery or the artist himself.

Besides that, all auctioned pieces are subject to stylistic risk, e.g. not having enough buyers when reselling the artwork (comparable to liquidity risk on financial markets). Buyers of liquid artists with a low stylistic risk usually attract the attention of speculators and financial investors. Pure speculators who consider art as an investment will want to avoid art segments presenting too much uncertainty (Frey and Eichenberger, 1995). Consequently, the investment risk from holding art decreases with an increases in holding period without substantial changes in return. Mei & Moses (2002) point out that art performs well over the medium term (10 years) and provides good diversification. The profitability of longer-term investment in art is as well supported by Goetzmann and Spiegel (1995).

[2] Participants being unequally informed about the artwork quality or resale value.

Chapter 3

ART AS AN ALTERNATIVE INVESTMENT

3.1 Defining Art as an Asset

In the past two decades, art has been considered, with increasing frequency, as an investment opportunity. Global art sales have tripled between 2003 and 2013 (Hodges, 2013). The possibility of repeated sales is what matters the most. Art as an investment, however, as outlined in previous chapters, cannot be judged on the same merits as traditional investments. Accordingly, to understand art as a professional asset class[3] might be tricky. It belongs to category of hard assets[4], which are unique, long-lasting, and hence collectible. Art is also utilized under the SWAG assets[5], which have physical properties and can be stored but produce no cash flow. To be more precise, they do not generate cash to secure liquidity for individuals and cannot be used as a source of income for operating activities.

Art yields return from its appreciation over time, and therefore is described as capital asset. It is hard to mass produce and provides the non-commercial benefit. That is the enjoyment and pleasure from viewing an artwork. In the 20th century, unlike nowadays, art was principally considered on its aesthetic merits. At the moment, while the role of aesthetic qualities is diminishing art has to be analyzed as a consumer durable.

To be more precise, art market is negatively correlated to the stock market in equities. The data in Table 3 clearly shows that art outperforms stocks during war and recession. As a result of the negative correlation of art to stocks, artworks have for long been considered an effective hedge against inflation and currency devaluation. In other

[3] An asset class is a group of securities that exhibits similar characteristics, behaves similarly in the marketplace and is subject to the same laws and regulations, e.g. stocks or bonds

[4] Physical assets with investments within its intrinsic value

[5] Silver, wine, art and gold assets

words, in inflationary environment art performs better than equities (Teti & Galli, 2014). During the week of 12 November 2012, over $1bn was publicly spent in New York at auctions alone, just two weeks after the city had been hit by Hurricane Sandy (Gerlis, 2014). Thus, art has been bought as an asset for protection that is especially effective at times of loose monetary policy. Art is used as a store of value in prolonged periods of rising prices. Returns to art are weakest when inflation is falling.

Table 3 *The Performance of Art in Times of Recession and Economic Unrest*

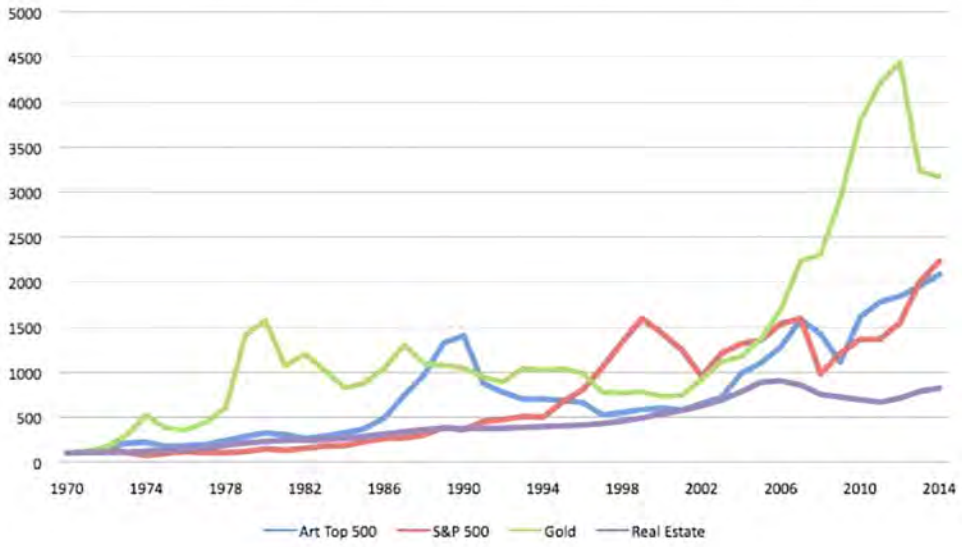
Dates	***Art***	***FTSE***	***S&P***
1913-15	-34%		
1913-18		-25%	-18%
1937-38			-50%
1937-39	88%		
1937-40		-50%	
1920	125% of 1913 value	94% of 1913 value	94% of 1913 value
1946	130% of 1937 value	104% of 1913 value	=1937 value
1954	108% of 1949 value		67% of 1949 value
1975	256% of 1966 value		27% of 1966 value

Source: Mei & Moses (2002)

3.1.1 Art & Gold

Until the economic downturn of 2008, comparisons of art to gold were few and far between (Gerlis, 2014). During the financial crisis, gold along with other SWAG assets was experiencing a boom. The interest was shifting to investments, which would store the wealth well and offer relative security. Figure 3.1 illustrates the performance of art based on top 500 artists and relative to gold (and real estate prices as well as the Standard & Poor's 500 stock market index).

Figure 3.1 Art as an Alternative Asset Class, 1970 - 2014



Source: University of Luxembourg (2014)

Further, gold is not subject to changes in government policies and central banking decisions. On the contrary, major central banks perceive gold as safe enough to be kept as an official reserve asset. During the 1930s depression gold held its value because of its official status. Yet, gold has no intrinsic value as it generates no income. But, unlike art, it can be instantly turned into money for a fixed price based on its status as a reserve asset. While works of art have no base value, the basis price for gold is regulated and should be approximately equal in all markets. The size of art trade is significantly lower than of gold. The former was in 2011 estimated at $60bn, while trade in the gold for the same year was assessed at $60tn (Gerlis, 2014).

Further, gold is near indestructible, has a relatively stable supply and is not subject to the most intangible factor, the "taste". The major source of demand for gold as investment is predominantly driven by its ability to hedge against political and economic uncertainty. Neither gold nor art can change for the worse. They also cannot change for the better. Consequently, there are associated costs attached to trading and owning gold. It has a public bid and ask price with sellers charging the premium above the given spot rate. Due to the uniform nature of the product, a typical premium is considerably lower than for art and ranges between 2% and 5% (Gerlis, 2014). Unlike art, and despite its function-free properties, gold is regarded as a liquid commodity.

3.1.2 Art & Wine

Both art and wine are non-income producing assets, which can go up in value. Investible wine is known as Investment Grate Wine (IGW) and typically improves with age and in large comes from one region in France – Bordeaux. Wine is bought to drink and finish, not for preservation for younger generations. The act of drinking has an immediate impact on supply that consequently effects the price. Unlike in the art market, where each art piece is unique and has no equivalents, after drinking a bottle of wine, there still might be plenty of bottles available.

Wine represents only a small market for auction houses. In 2012 wine accounted for around 1.5% on Sotheby's revenue in the UK and around 3.5% in Asia (Gerlis, 2004). The wine market is relatively young, the right to auction wine was first granted in New York in 1993, compare to first art auction that was held in 18th century. Merchants usually use Liv-ex's exchange of top-100 traded wines (the Liv-ex 100) listed on Bloomberg's system to access the real-time price information. Unlike with art, transparent pricing is possible mainly due to high volume of few wines, which make up the wine market. In 2011, eight wines made over 80% of wine fund's portfolio by value (Gerlis, 2004).

In economic terms, to achieve success in the wine market means to get a correct price-to-quality ratio. To understand the quality well, a combination of expertise and experience is necessary, similar to the knowledge required on the secondary art market. But the prices charged for fine wine are considerably lower than those charged for Blue Chip artworks. The market for wine ranges from around $2 a bottle to $20,000 at the top end (Gerlis, 2014). Wine market demonstrates that the size of any market is not detrimental for its success. More important seem to be price points, high volumes of trade and a level of classification system.

3.1.3 Art, Stock Markets & Private Equity

Although, society considers art as a tool solely for investment purposes to be unethical, some investors are in just for the money. In 2014 art funds had an estimated value of

$1.26 billion in assets under management (Hodges, 2015). Instead of directly owning the artworks, investors gain access to art pieces they cannot afford on their own. The typical investment term is between five- to ten-years. Internal rate of return is approximated at 10% to 20% (Gerlis, 2014). In 2011, Deloitte and ArtTactic estimated total of 44 art funds, out of these more than half was located in China for which data is scarce, several more are known to close immediately after inception.

Art exchanges, which reflect the continuing pursuit for liquidity in art, use Art Certificates (shares) as liquid and transparent financial instruments to operate under similar principles to stock exchanges (Blouin Corp, 2018). To be more precise, a painting is broken up to equal parts and each essentially de-risked part is sold to investors while watching the value of the artwork evolve that is reflected by the demand and supply for 'shares'. This approach has merely something to do with artworks themselves, the principle lies in betting properly on growth in art value and might be well categorized under speculating. Authenticity of artwork with status and value aid the speculation of type "long". Speculators together with activity from art funds and private individuals who store artworks in warehouses, bank vaults or in free ports, where the aesthetic return is none confirm the potential of art as an alternative investment. Further, arbitrage (strictly speaking, Capital Gains, since transactions are always subject to certain risk) in the world of art is a common and very profitable activity (Robertson, 2005). In other words, one buys an artwork in emerging markets where the sale prices achieve lower levels and afterwards resells the art piece in well recognized art center (e.g. London) that allows for premium prices.

If comparing the risk and return on financial and art markets, the former provides higher return and lower risk (Mei and Moses, 2012). Especially, stocks in the developed markets make better returns in relation to their investment risk but are highly volatile and diverse in the quality in each company stock. Art may be of a similar riskiness as the trade in "penny" stocks, which don't trade on the major market exchanges. To be more precise, financial markets are homogenous, defined by frequent transactions and provide high level of certainty. World All Art Index reports a compound annual return of 7% for the period between 2003-2013, compared with 7.4 % for the S&P 500 (Hodges, 2015). Consequently, for an art market index to make sense of its performance, it needs an equivalent benchmark index. Using volatile equities as a

proxy might be one solution, however, the arbitrage pricing theory (APT) as proposed by Chen et al. (1986) that allows for price to earnings ratio (P/E) and pre-specified economic factors seems to provide better results. Gerlis (2014) goes on and suggests that Art Exchanges, which aim to provide daily prices of the constituent works could act as a benchmark index for the value of all artworks. To this point, there is not a proxy index that accounts for taste against which the volatility of art would be measured. Thus, the absence of any feasible benchmark for art makes art valuation and accounting for risk in the art market much less effective and accurate than in the stock market.

Additionally, pieces of art can be used as collateral for loans (McAndrew and Thompson, 2007). It is also possible to use Art Credit Default Swaps where a bank lends money to an entity and buys the option from a third party (the seller of protection). This security gives the bank a right to swap the art object against the cash would the borrower default. In the 1980s the popularity of guarantees was very strong. Price guarantees underwritten by auction houses are similar to short positions in put options (Greenleaf et all., 1993). They create an impression of demand while building up confidence in clients. Guarantees artificially boost the market and reduce the volatility. But they make the art market opaque as it is impossible to draw credible conclusions on the market's demand on guaranteed prices. Guarantee agreements are negotiated in private before the sale which diminishes the transparency of market pricing.

3.2 Determining the Value of Art

The collective value of art is based on collective intentionality. Unlike with the value of equity where productivity, profits and expected returns form an objective base, there is no intrinsic, objective value of art. Human stipulation and declaration create and sustain the commercial value (Markopoulioti, 2017). Our contemporary understanding of this notion, makes money its best synonym (Robertson, 2005). In other words, art is an investment of passion and the motivation behind a purchase of any artwork might to a great extent account for its intangible value.

There are two principles, which do not change: art never loses value and should always be a part of diversified investment portfolio[6]. Markopoulioti (2017) explains that art investment should represent maximally 30 percent of any portfolio and include artworks with low volatility. Thus, mainly artworks by earlier authors, excluding contemporary art. Among the most liquid artists are predominantly authors from modern avant-gardes, namely Claude Monet and Pablo Picasso (ArtPrice, 2018). The main advantage of art investment lies in its ability to diversify within the asset sector[7].

Consequently, we recognize internal and external factors affecting the value of artwork. The latter category represents conditions, under which the art pieces are sold, e.g. author's name, time of sale, venue of sale, location of sale, lot sequence[8], catalogue position and bidding wars, all very valuable for quantitative analysis. Additionally, there is provenance that is difficult to account for and available literature hardly mentions it. The former category includes the artworks themselves. That is the factors such as the subject matter, medium, size, and the year of creation. Subject matter is very taste dependable. Size is crucial with photography and contemporary art but doesn't matter much with older artworks (Robertson, 2005). Neither the ratio of length of sides of an artwork influences the resulting price. The tall and narrow artwork may be sold for the same price as a square one.

The most intangible factor that determines the value, and hence the sale price is 'taste'. Important is the taste of connoisseur who exercises a great power over the exchange-value of artworks. Likewise, collectors are not just a purchasing power of the art market, they actively shape it and change it according to their tastes. At any given time, certain types of artworks are preferred over others (Gerlis, 2014). If artist becomes a brand name, the value of his artworks increases substantially and may gradually reach the status of Blue Chip artwork. These facts simply reveal that the art market is far from conforming to conditions of perfect markets and the Efficient Market Hypothesis

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[6] A well-balanced investment portfolio, e.g. between stocks, bonds, art, and other financial instruments.

[7] Diversification between art market key genres, artists and types of works.

[8] A number given to each artwork at an auction, representing its auction order as well as its artistic and cultural importance.

(EMH) of E. Fama. This is to say that it is impossible to "cheat the market" consistently and persistently, since market prices should only react to new information and are immune to market rigging. Art market is asymmetrical, imperfect and the sale prices do not reflect all published as well as unpublished data. Profitability of one's experience may, therefore, be determined by the right timing of entry and exit into and out of taste (Robertson, 2005).

Authenticity issues are often a subject of heated discussions. An artwork may be proved authentic by being included in the catalogue Raisonee (Markopoulioti, 2017). Also world renewed experts may declare the art piece to be authentic and thereby increase its value. Provenance points to the history of previous ownership of the artwork and works as a proof of authenticity too. It can improve the monetary status of artwork if owned by a significant person. Consequently, the more unique the work is, the higher the price. If the piece is of crucial importance and representation, the prices can sky-rocket (Markopoulioti, 2017). Likewise, strong series of literature and exhibitions backing the artwork can significantly influence the sale price.

Nevertheless, the approach of using art price indexes which collate historical prices as a benchmark for valuation has been increasing in popularity. These indexes have been created with the intention to demonstrate patterns, suggest future performance and provide comparisons to other potential investments. They are very often used in econometric modeling. Among the major ones are: Mei Moses All Art Index that only considers data from Sotheby's and Christie's, Knight Frank Luxury Investment Index and Blouin Art Sales Index (2018) that is used as a main data source in this thesis. The construction of art indexes is, however, impeded by several factors: art does not sell frequently, each artwork is unique, there is relatively small number of bidders per work, and there is private value component embedded in every art piece (Robertson, 2005). Besides these, most art market indices only offer partial price information. They are strong on tertiary market (auction market) but do not provide any record of private sales. The assumption that indices reflect entire economic activity and that prices momentarily adjust to available information does not apply to the art market (Robertson, 2005). In other words, it is not clear whether an index should be considered as the best way for measuring the progress of art commodities. It might be the case that written well informed analysis provides much better understanding.

3.3 Art Auctions

Over the past two decades the number of auction houses has rapidly increased (ArtPrice, 2017). The leaders on the market are Sotheby's and Christie's, closely followed by Phillip's and Bonham's. Auction houses announce weeks to months in advance the dates when auctions will occur (Bocart, 2011). Prior to any auction, the auction house publishes a catalogue where each lot is linked to the low and high pre-auction estimates and a description[9].

Important part of any auction house are art dealers, who are classified into three categories: alfa, beta and gamma dealers. The responsibility of alpha dealers as the most experienced ones is to create the value and to act as price stabilizers. Those with a significant information on certain categories of art or on emerging markets are able to control supply and set prices (Robertson, 2005). Beta dealers have lower influence and enjoy less responsibilities. Gama dealers represent mostly newcomers with very little experience and limited networking capacity.

Art auctions are categorized under English auctions. With this auction type each seller sets his reserve price[10] independently, if the offered price exceeds this level, the bidding stops and the artwork is sold, otherwise, the art piece if left unsold. By convention, the reserve price is not published and usually set at slightly below the low estimate in order to provide the buyer with an indication of the value. Sotheby's has the reserve price set at 20% less than the low estimate (Markopoulioti, 2017).

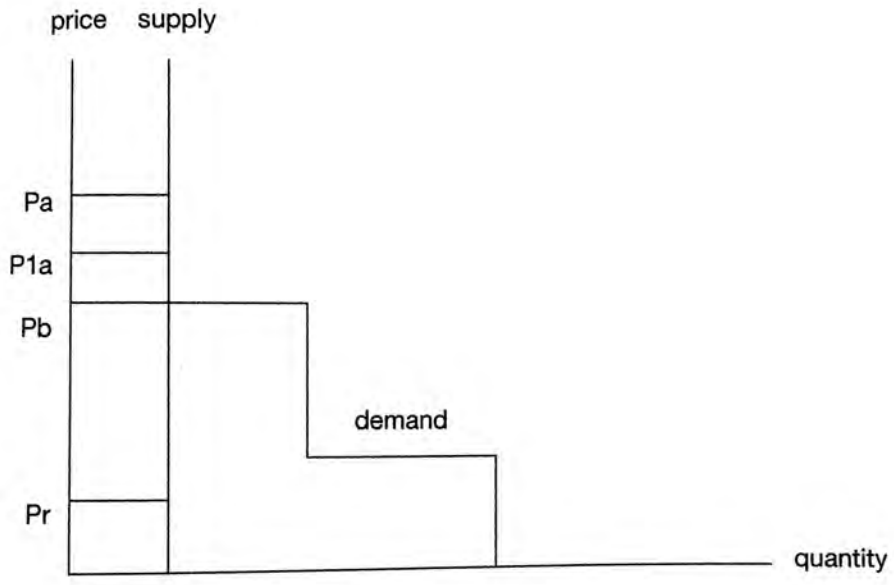
Even though the predicted and actual prices are positively correlated, the actual prices are usually underestimated (Teti & Galli, 2014). With less known artworks, which are plenty, doubts might be expressed over the reasonability of low and high estimates. The seller does not have the certainty that there will be any buyer and might not want to set the reserve price below the expected value of the artwork. This results in reserve price being set higher. The auction house may account for the situation by setting the high estimate at lower level. It might happen that an artwork is sold for less than its

[9] Key variables are recorded systematically but length of the description differs from one author to another

[10] The fixed price that the seller has decided he will not sell under

lower estimate but never below its reserve price. In reality and due to the nature of estimates construction this is rarely the case. At the same time, there are countless artworks in great demand. If the seller is fully aware of the demand and is expecting large amount of bidders, he might want to decide to set the reserve price at a lower level. This approach usually attracts many buyers, who, in turn, induce a wave of bidding, boosting the sale price upwards. In general, the situation in the auction house with more than one bidder can be described as shown in Figure 3.2. According to step-stair method, the number of potential bidders is indicated by a discontinuous demand curve. The most interested bidder (A) might willingly pay Pa, but in reality only needs to offer P1a to win the bid over bidder (B) at Pb. In any case, the price received by the seller exceeds the reserve price, Pr, and the bidder preserves some consumer surplus.

Figure 3.2 The Clearance of Art Through Auction



Source: Robertson (2005)

In fact, auction houses get paid, both, by the seller and by the buyer. But they act on behalf of consignors (sellers), whose commission can be a broad range from 6-10%. These rates are set in a very obscure way in order for auction houses to keep considerable level of flexibility. If an auction house really wants to sell the art piece, it

usually waves the commission because a prestigious artwork adds status to the company.

There are four ways to bid; either directly in the room, at the phone[11], online or by submitting a written bid. As a result of globalization of the art market, the highest number of biddings has been registered on the phone with buyers coming from over 70 countries (Markopoulioti, 2017). The average bidding time per lot is two minutes, big competitive lots can go over five to six minutes. Auction always opens with easily sellable lots adding up to the momentum. Top lots are spread to the first half of the auction, since the prices in the first half are always above the average (Markopoulioti, 2017). In case the artwork is not sold at auction, post-sale private offering follows with a potential discount. Alternatively, parties may agree on including the artwork at another auction with lower estimates. An artwork that has been offered at an auction twice and has failed to sell is called "burnt work". The seller is required to keep such artwork out of the market to recover its public failure.

[11] The most popular form at the moment because it provides high level of privacy

Chapter 4

DATA DESCRIPTION & MODELING

4.1 Data Description

This thesis aims to identify and explain the determinants influencing the financial appreciation of works of art. Being aware of key factors, which affect investment into art might help to discover why some artworks are sold for extremely high prices while others just manage to hit their low estimates. Auction process represents an opportunity to record information, since private transactions (i.e. transactions off the auctions) are not obliged to public record, hence are absent in any data analysis. Therefore, we take the data from art auctions as a reflection of the whole art market. Using just the auctions records, however, means we are predicting the behavior of the whole art market based on one part of it (Markopoulioti, 2017).

To be more precise, Blouin Art Sales Index (BASI) represents the main source of data for this thesis[12]. The company, Blouin Art Sales Index, is one of the leaders in art publishing industry worldwide. It is an organization that facilitates cultural news, guide books & magazines and covers events in the art market. It administrates one of the largest databases that provides auction results to the general public, so called Blouin Art Sales Index (BASI). Auction market is a relatively vivid market with abundant number of transactions reflected in the size of the BASI database, comprising of 5 million auction records from all over the world. Auction results, of course, include unsold works, officially referred to as 'bought-in' works, where only the lower and upper estimates are available but not the sale price[13]. Since the sale price is considered of utmost importance for our analysis, bought-in works are not part of our dataset. The selection creates a sample of 29 artists and 21,782 auction results. Due to missing

[12] These data are used purely on academic and non-commercial purposes.

[13] Such situation occurs when a bid of a potential buyer isn't high enough to cover the reserve price; that is the minimum sale price.

quantitative characteristics of some artworks, the number has later been reduced to 11,464 records. The major decrease in auction records has been caused by inappropriate low and high estimates, which used 0 as a factor. Thus, being highly unsuitable for our regression analysis. This has consequently decreased the selection of auction dates to the years after 1994. Moreover, the category of Old Masters had to be excluded due to the unavailability of measurement characteristics. This restriction led to a shortening of time horizon to the period after the year 1800, in terms of year of creation.

Further, artist's death negatively affects the sale prices by frustrating expected future name recognition of the promising artist (Ursprung & Wiezmann, 2008). The extent of the effect strongly depends on the fact whether the death was a consequence of high age or an unexpected occasion. Thus, only deceased authors who died of natural causes and whose oeuvre is, therefore, capped are subject of our econometric analysis. This condition had reduced the list of authors to those born before the WWII. Moreover, Gerlis (2014) suggests that the supply of investment-grade artworks in the market by dead artists is falling and the price-to-value ratio is being stretched to its limits.

For the thorough understanding of this paper it is important to explain the notion of "art piece" and "artwork", which specifically refer just to three categories of fine art, e.g. Paintings, Works on Paper, and Photographs made by artists ranked amongst the top 100 in 2018 according to Bluin Corp (2018). The categories for Prints and Sculptures were excluded due to the lack of data and different nature of artistic form. We focus on Blue Chip artists, since they are more likely to be seen both as consumption goods and investment goods, unlike many little traded artists whose objects are more likely to be bought as pure consumer goods (Bocart, 2011). The additional descriptive statistics are outlined in tables in Appendix A.

The dataset of auction results includes the following information: artist's name, artwork's name, category, medium, year of creation, auction house, auction date, location of auction, lot number, auction type (the theme of the auction sale, e.g. modern, impressionist, etc.), low estimate, high estimate, sale price in US dollars including buyer's premium, provenance, and information on signature (if present). Some factors, which influence the sale price are omitted, namely exhibition, transport costs as well as storage and insurance due to data unavailability. To better understand the gathered data, Table 4.1 shows a sample of auction results.

Table 4.1 Data Sample of Auction Results

	ART #1	ART #2
ARTIST	Edgar Degas	Piet Mondrian
ART NAME	Danseuses à la barre	Composition No. III, with Red, Blue, Yellow, and Black, 1929
LOCATION OF AUCTION	London	New York
AUCTION HOUSE	Christie's	Christie's
AUCTION DATE	24.06.2008	14.05.2015
AUCTION TYPE	Impressionist and Modern Evening Sale	Impressionist and Modern Evening Sale
LOT NUMBER	9	6
CATEGORY	Works on Paper	Paintings
MEDIUM	pastel, gouache and charcoal on paper	oil on canvas in the artist's painted frame
SIGNATURE	signed and indistinctly inscribed 'Degas'	signed with initials and dated 'PM 29'; signed again 'P MONDRIAN'; inscribed 'HAUT N: III'
YEAR OF CREATION	1880	1929
LOW ESTIMATE	7,882,800.00	15,000,000.00
HIGH ESTIMATE	11,824,200.00	25,000,000.00
CURRENCY	USD	USD
SALE PRICE	26,567,499.00	50,565,000.00
PREMIUM/HAMMER	Premium	Premium
PROVENANCE	Mr and Mrs H.O. Havemeyer, New York. Mrs Electra Havemeyer Webb New York, from 1929. Mrs Electra Webb Bostwick New York, from 1960; sale, Christie's, New York, 3 November 1982, lot 44 ($1,045,000). Acquired by the present owner circa 1985.	Michel Seuphor, Paris. Alberto Sartoris, Geneva. Galerie d'Art Moderne, Basel (circa 1950). Théodore Bally, Montreux Private collection, Europe Estate sale, Christie's, New York, 14 May 1997, lot 9. Private collection, New York. Acquired from the above by the present owner, 2009

Source: Blouin Art Sales Index (2018)

From the above table very important are the following measurements of value: sale price including buyer's premium, low estimate and high estimate. Auction houses publish, both, Premium and Hammer prices providing two different measures of sold artworks. Hammer price represents the actual winning bid for a lot (not included in our data set). Premium price as the most commonly quoted price by auction houses and press is enlarged by buyer's premium that is added to the sale price above the hammer price and paid to the auction house. The buyer's premium charge is used to finance the shipping and handling of artworks and to deal with paperwork on behalf of the buyer.

As long as the art work is sold at an auction, auction houses charge the buyer's premium for the sold artwork (ArtPrice, 2018). Different auction houses charge different premium rates, depending on the auction house's prestige and the actual level of hammer price. Sotheby's and Christie's buyer's premium for artworks up to $ 300,000 equals to 25% of artwork's value, for artworks between $ 301,000 – $ 3,000,000 they charge 20% and for works higher in price than three million dollars, the premium equals to 12.9% of hammer price (Markopoulioti, 2017). In situations when the artwork is 'bought in' its set reserve is its hammer price. To cover increasing structural and marketing costs, auction houses have repeatedly increased the premium charged, the average increase for 20 years has been 45% (ArtPrice, 2017).

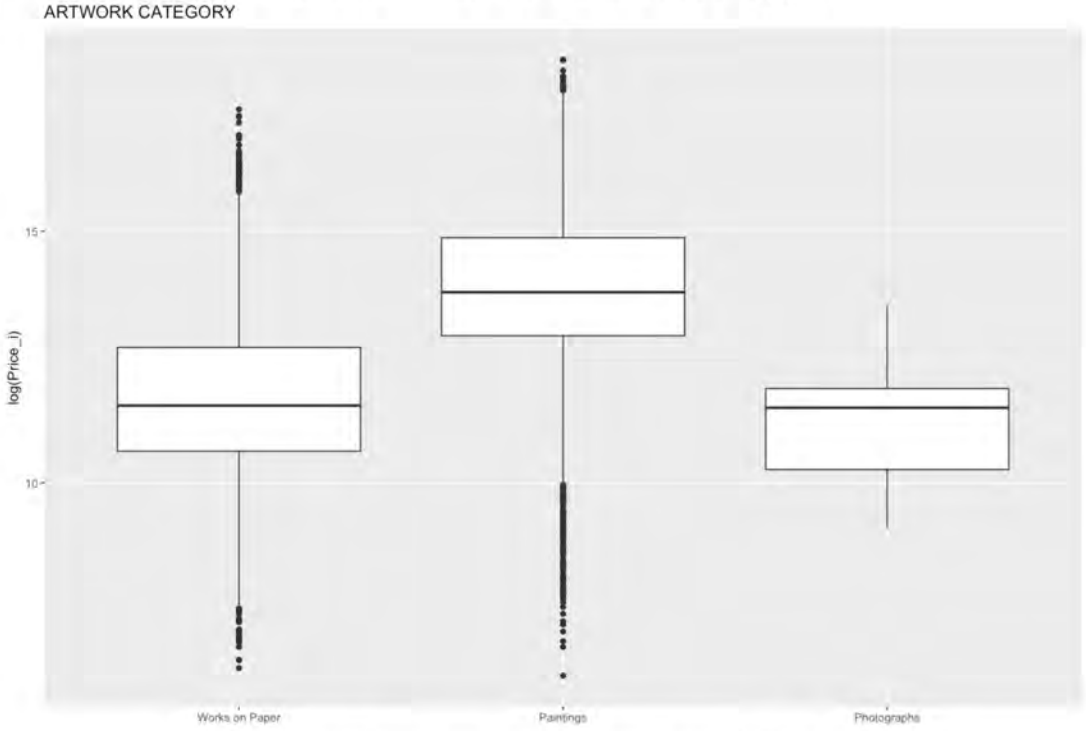
Consequently, to avoid the dilemma in deciding whether to use nominal or inflation adjusted prices, premium prices together with low and high estimates were all recorded in US dollars and afterwards corrected for changes in monetary value. Since information on inflation in the art market is not available, there was a need for alternative sector from where to acquire the deflators. For the sake of simplicity, we assumed that inflation is constant across all countries and used the GDP deflators of the UK, which were on average 2% per year. Both, prices and estimates have been converted to present moment, hence the year 2018.

4.1.1 Factors Influencing the Price of Artworks

In this section factors influencing the sale price of artworks are discussed in detail. Of great importance are categories of artworks, which we assume should fetch different

prices. The mean value for paintings on Figure 4.1 is placed visibly higher than for the other two categories. We suspect that the category of paintings (canvases with oil paint) yields the highest prices, mainly due to the nature of creation process that is highly demanding, both, for skills and drying time. The qq-plot below also suggests that the categories for works on paper and photographs are valued similarly.

Figure 4.1 Artwork CATEGORY QQplot



Source: Author's own computations using BASI (2018)

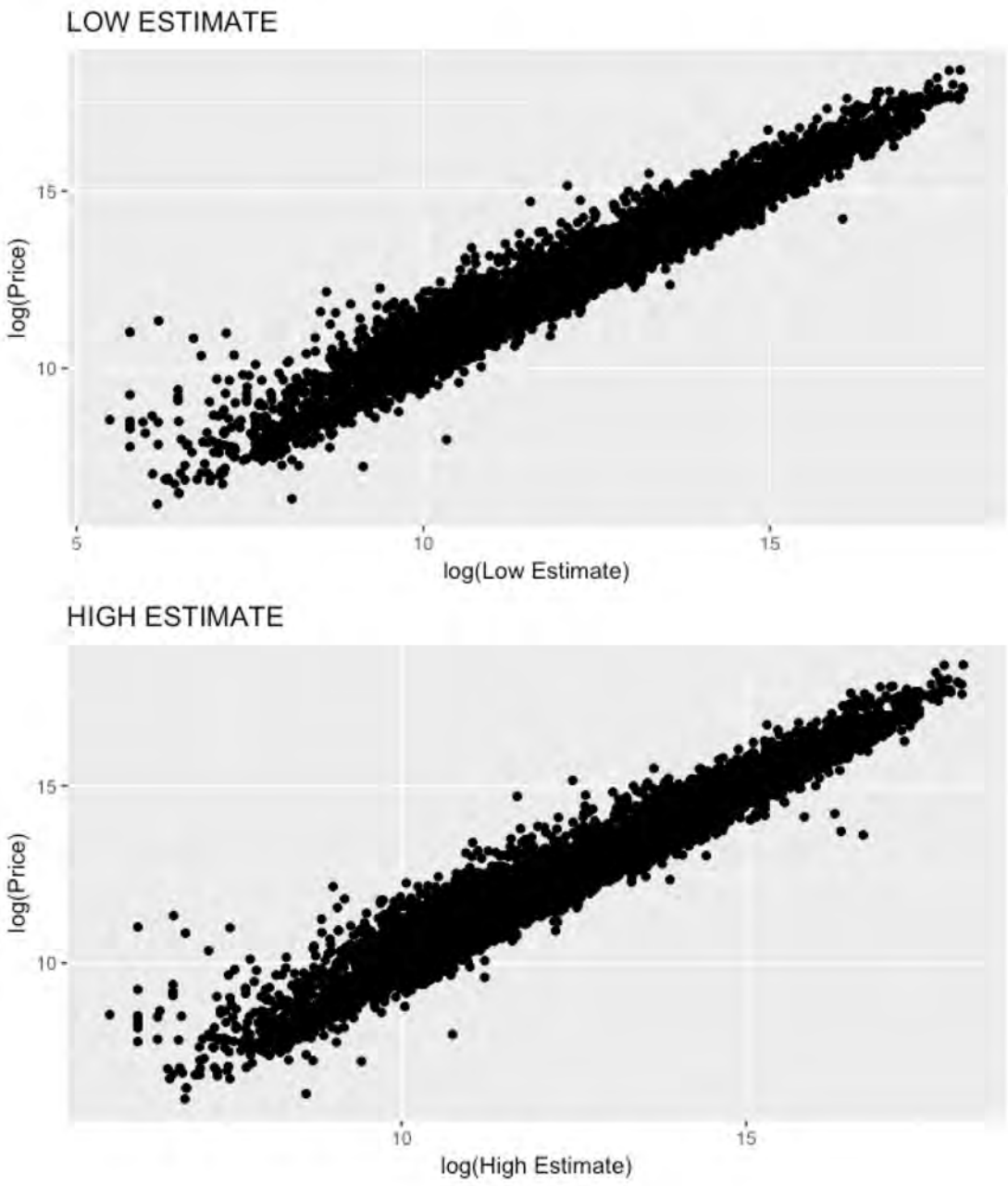
In recent years, with increasing demand for art pieces, the emphasis has been put on signed artworks, which should provide a statement of authenticity (Markopoulioti, 2017). In our data set there are twice as much singed artworks than those with missing signature. This suggests that signed art pieces are preferred, and hence we assume in line with our 3rd hypothesis that signature might positively affect the sale price.

Equally important are the auction houses, which have been divided into four classes according to their influence and importance on the art market. Small and Medium classes were created based on the information available on Blouin Corp (2018). The

first class represents small and less known institutions. The second one is for well-known and established auction houses. Interestingly, more art pieces were auctioned in small rather than the medium size auction houses. Separate classes have been created for Sotheby's and Christie's auction houses. Auction house duopoly is deemed more serious than are others, in consequence, it charges brand premium for the status (Gerlis, 2014). If these auction houses decide for any kind of change, remaining auction houses do not have much choice but to follow suit. In line with our 2nd hypothesis we regard the auction house where the work is being sold as a crucial determinant of the sale price. We assume that having the art piece auctioned in Sotheby's or Christie's, where most of the Blue Chip artworks are sold, increases the value significantly.

Consequently, the duty of the auctioneer to properly appreciate the auctioned works should not be underestimated. In order to not face the claims from the sellers, auctioneers have to express a considerate opinion about the artworks' value. Thus, the price estimates might be regarded as the best opinion of auction house experts on the value of a particular artwork with respect to available information. Their aim is to help potential buyers correctly appreciate the artworks in financial terms. The question remains, if the low and high estimates are following some exogenously given criteria or if they are able to "create" the price. The latter would signal that auction house experts could speculate (or even play a corruptive game) favouring either sellers or buyers. Figure 4.2 shows dependency of continuous variables in our dataset – low estimate and high estimate on the Sale Price. We observe a strong linear trend on both graphs, which is not surprising because auction house experts have access to privileged information while estimating the sale price, and hence we assume that the sale price can to a great extent be determined by the low and high estimates.

Figure 4.2 LOW & HIGH ESTIMATES



Source: Author's own computations using BASI (2018)

In the ten years' period prior to the financial crisis, the prices of art had extremely benefited from the corresponding economic boom (Markopoulioti, 2017). Ehrmann 2016) points out that the year 2007, just before the financial crisis, was very productive with art prices reaching their all-time high. Accordingly, we assume that the auction date might play an important role in determining the sale price, and hence eight classes

have been created for respective auction dates. We expect a sudden fall in prices during the 2008-2009 period and their subsequent quick recovery. We also suspect that the periods following the year 2013 will show a steep increase in the sale price.

The decade, in which the artwork was created is not just an indication of age but a display of contemporary collectors' tastes for certain art movements. With this in mind, we want to uncover the art movements, which are better appreciated in price, and hence years of creation have been grouped into six classes for the respective time periods. Some imperfections are present in the dataset due to missing year of creation for certain artworks. These faults are mostly observed in the earlier decades of the studied period. We associated them with the early creation of artworks. In order to avoid the sample selection bias and to keep the observations in the dataset, artworks with missing year of creation were classified to each time interval class according to a period of production of their artists.

Consequently, locations of auctions have been divided to three classes based on their art importance according to Blouin Corp (2018). The first class is for towns with little artistic influence – Prague. The second class is formed by towns with considerable artistic influence and well-established art institutions, e.g. Zurich. The last group consists of highly productive cities, which are regarded as notable art locations, namely London, New York and Hong Kong. According to our 1st hypothesis, we assume that artworks auctioned in one of these cites fetch significantly higher prices.

Finally, there are 29 authors in our data set, all of them being regarded as Blue Chip artists. Even within this top category of artworks we expect considerable differences in prices. Each author is assigned to an individual class, however, there are disparities in the extent of artists' oeuvre. Very poorly represented is Thomas Cole whose oeuvre only creates 28 artworks. On the contrary, the highest number of art pieces may be assigned to Alexander Calder. We suspect that artworks by Vincent van Gogh, Pablo Picasso and Claude Monet will have strong positive affect on the formation of the sale price due to their well-established reputation in the art market.

4.2 Model Specification & Methodology of Hypothesis Testing

In this thesis we are developing a regression model that takes into account characteristics and qualities of individual works, hence aims to explain the nature of artworks' price by a list of significant variables. To make interpretation more comprehensive, we aspire to prove a linear regression model applying OLS as the most commonly used estimation method.

In the econometric models variables measuring price and income are usually applied in logarithmic form. The regression model used in this paper is no exception. However, level-level model is used to demonstrate high correlation between high and low estimates and their strong linear relationship, which would lead to multicollinearity:

$$HE_k = \beta_0 + \beta_1 LE_k + \varepsilon_k \quad ; k = 1, 2, \dots, 11464 \quad \textbf{(1)}.$$

The level-level regression allows for more understandable explanation of coefficients, in our case the markup. In other words, if the explanatory variables in equation (1) changes by one unit, the explained variable will change by β_1 units (Wooldridge, 2009). Precise explanation of each variable can be found on the next page. Consequently, we use another model, where the variables in cardinal scale are in logarithmic form (the sale price and low estimate) to demonstrate the fundamental relationship between these two variables:

$$log(price_k) = \beta_0 + \beta_1 log(LE_k) + \varepsilon_k \quad ; k = 1, 2, \dots, 11464 \quad \textbf{(2)}.$$

Use of logarithms of prices and their low estimates in equation (2) leads to easy interpretation, i.e. approximate change in the response probability of price measured by percentages when the low estimate changes by e.g. one percentage point, holding all other factors effecting the price fixed (Wooldridge, 2009). After transforming the data to logarithmic scale, the coefficients represent price elasticities.

Variables included in the final model were chosen according to the theoretical factors determining the price of artworks whose value cannot be explained by costs of production (e.g. a supply curve like in setting of prices for material industrial products, which are under cost competition). As a factor, there is the prestige of an artist plus prestige of the auction house and the time of auctions, since art is subject to a time

dependent speculative boom. Thus, the variables accounting for auction house, auction date, location, category, and artists' dummies are included in the model. To present the log-level model of the sale price by chosen variables a power function is used:

$$log(price_k) = \beta_0 + \boldsymbol{A}^T\boldsymbol{\beta}_A + \boldsymbol{L}^T\boldsymbol{\beta}_L + \boldsymbol{AH}^T\boldsymbol{\beta}_{AH} + \boldsymbol{AD}^T\boldsymbol{\beta}_{AD} + \boldsymbol{C}^T\boldsymbol{\beta}_C + \varepsilon_k \quad ; k = 1, 2, \dots, 11464 \qquad (3)$$

where;

$\boldsymbol{\beta}$	regression coefficients
Price	represents the real Sale Price of artworks at auctions in USD (Explained variable of model (2) and (3), cardinal scale)
HE	represents High Estimate of the sale price (Explained variable of model (1), cardinal scale)
LE	represents Low Estimate of the sale price (Explanatory variable, cardinal scale)
A	Matrix of Artist dummy variables (Explanatory variable, 28 degrees of freedom, equal to 1 if an artwork of particular artist is sold)
L	Matrix of Location of auction dummy variables (Explanatory variable, two degrees of freedom, equal to 1 if sold in a particular location class)
AH	Matrix of Auction House dummy variables (Explanatory variable, three degrees of freedom, equal to 1 if sold in particular auction house class)
AD	Matrix of Auction Date dummy variables (Explanatory variable, seven degrees of freedom, equal to 1 if sold in a particular period)
C	Matrix of Category of artworks dummy variables (Explanatory variable, two degrees of freedom, equal to 1 if an artwork from a particular category is sold)
$\boldsymbol{\varepsilon}$	Error term
k	index of individual artworks, from 1 to 11,464.

Variables included in the regression model (3) are selected using backward selection process. It is a reverse process where all explanatory variables are entered into the equation first and those, which do not contribute to the regression equation are deleted one at a time. Disadvantage of this approach is, however, the possibility of having inadequate initial model. To avoid this problem different initial models are used, separating variables, which share a high potential for multi-collinearity.

Nevertheless, to elaborate on the relationship between high and low estimates is of high importance. The correlation between these two variables is extremely high, 95%, which points to their strong linear relationship, i.e. high estimate is an x-multiple of the low estimate using a constant coefficient x. This hypothesis is also supported by the results of simple regression from equation (1), to be more precise, if we increase the low estimate by 1 USD, the high estimate will increase by 1.410 USD. After transforming the model to logarithmic scale we arrive at explanation that increasing the low estimate by 1% will result in 0.999% increase of high estimate which nicely emphasizes the robust linear dependency of these two variables.

Consequently, the equation (2) was used to demonstrate that low estimate is a result of educated, very precise and detailed valuation of experts which might compete with the regression model itself. The coefficient on low estimate at 0.939 suggests that if we increase the low estimate by 1% the sale price will increase by 0.94%. Experts who create the estimates achieve extremely high level of precision because they are able to account for anomalies, which our regression model keeps in error term. Indeed, by including logarithms of either low or high estimates into equation (3) the results show that estimates capture over 90% of the sale price and work as a benchmark that is consequently only slightly improved by the remaining high number of dummy variables. In this sense, low estimate would be a fundamental variable of our regression model outlined by equation (3). To be more precise, regressions which include either low or high estimate (always just one to avoid violation of multicollinearity condition) test a hypothesis that experts have included all available information and there are not any variables, which should be accounted for to improve the estimates. Our results suggest that there is still a little scope for improvement.

The final regression model as set in equation (3) abstracts from the benchmarking set by the expert expected low estimate that is the only explanatory variable in levels, i.e.

cardinal scale. Thus, we concentrate exclusively on the 'creative core' of the value creation of an art piece which is dependent exclusively on the qualitative determining factors and these, in turn, can be quantified exclusively by binary dummy variables. To further support our choice of final regression model, Egger (2015) argues for models in trade (i.e. the value of export as explained variable), which are switching to regressions exclusively with dummy variables.

In addition, to test whether the chosen categories of variables have a significant impact on explaining the sale price we have conducted the test that compares the mean yields of explanatory variables by analysing the variances (ANOVA). The analysis proved the Year of Creation variable to be insignificant, and hence it has been excluded from the final model. The variable Signature did not show any significance either and was consequently omitted from the final model too. The exact results of ANOVA for the chosen set of variables are available for see in Appendix A.5. Since we have been looking for a model that shows variables, which determine the price objectively without the price estimates of experts, a model demonstrating the highest satisfaction with BLUE conditions[14] and the highest value, in terms of interpretation of coefficients was kept. The goodness-of-fit measure for the chosen model shows it has a certain explanatory power; $adjusted\ R^2 = 0.659$. Our model is in cross-section with dummies for authors and time, adjusting the estimates for the data akin to panels.

4.3 Model Validity

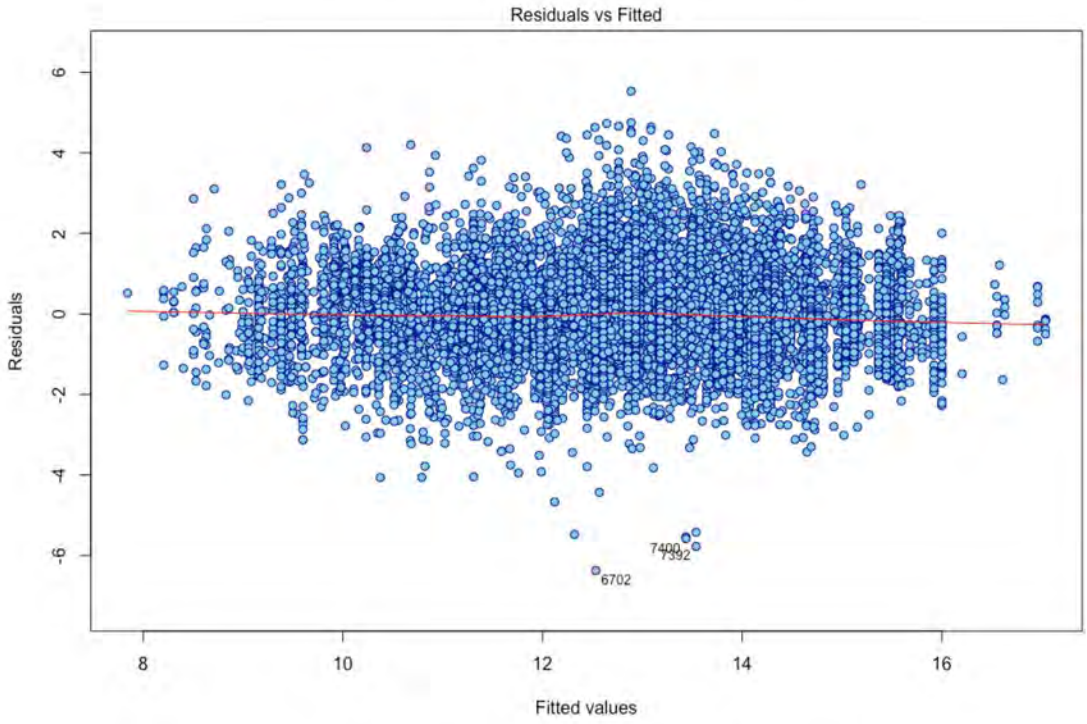
In order to rely on the model estimates, the assumptions of the linear regression model have to be satisfied. As shown in Figure 4.3, we assume that assumption about linearity in parameters (MLR[15] 1) is satisfied. This paper also assumes that the data used in the regression originated from random selection (MLR.2) and have zero conditional mean (MLR.4). Since the data were obtained from the Blouin Art Sales Index server, the sample of observations is supposed to be random. According to Wooldridge (2003) MLR.4 is not possible to test but the maximum possible number of variables was used

[14] Best Linear Unbiased Estimator is the OLS estimator that satisfies assumptions MLR.1 – MLR.5.

[15] Multiple Linear Regression

to ensure that the explanatory variables will not be correlated with the error terms. Our endeavor is to eliminate the presence of endogeneity in variables, avoiding the cases of omitted variables and simultaneity between two exogenous variables. Thus, assumptions about multicollinearity of data (MLR.3), homoscedasticity of disturbances (MLR.5), and normality of disturbances (MLR.6) remain to be tested. Let us stress that our model is in cross-sections and not in time-series where the autocorrelation of residuals should be tested.

Figure 4.3 LINEARITY IN PARAMETERS

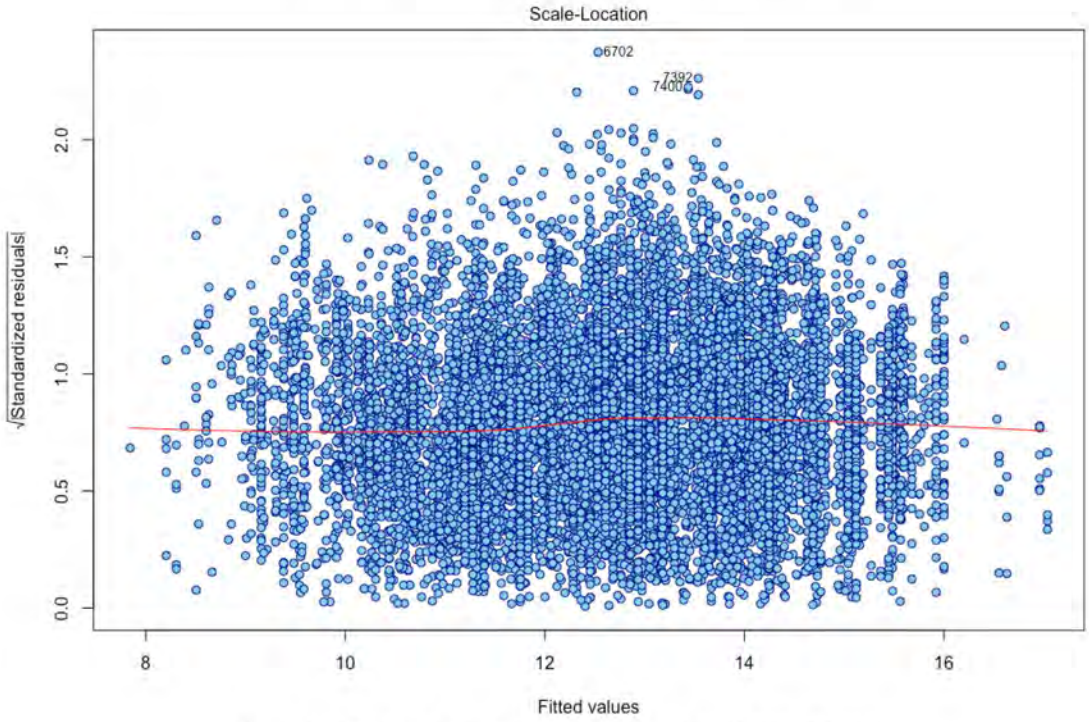


Source: Author's own computation using BASI (2018)

Consequently, to test that our model satisfies assumption MLR.3 and does not suffer from collinearity between explanatory variables (i.e. estimates do not have large variances) as is usually the case variance inflation factor (VIF) was used. The highest value of 3.424 was detected for artists' variable. Yet, this value is largely below the limit of 10.0 for permitted multicollinearity. In other words, our data satisfy assumption about multicollinearity.

To test the homoscedasticity of residuals (MLR.5) a visual method was applied using the Spread-Location plot that illustrates a distribution of points across predicted values range. Figure 4.4 shows residuals spread similarly across the entire length of the trend line. Despite the very slight instability observable in the middle of the plot, the trend line is horizontal and the assumption about homoscedasticity of residuals is not broken.

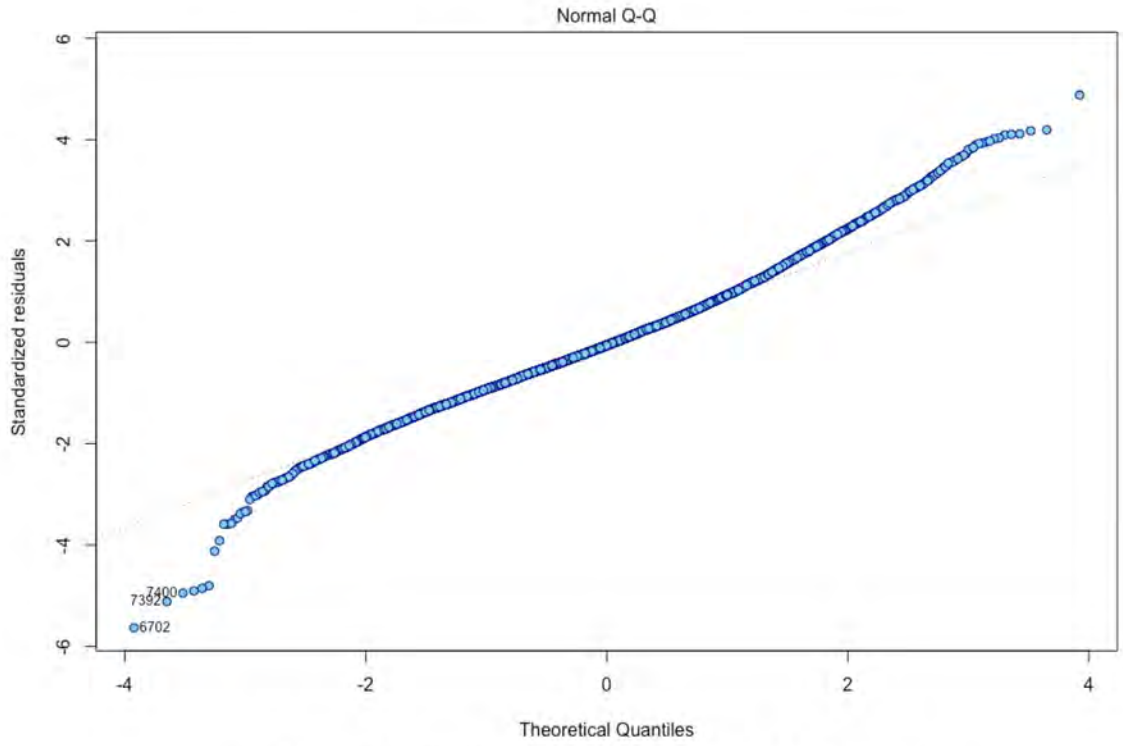
Figure 4.4 HOMOSKEDASTICITY OF RESIDUALS



Source: Author's own computation using BASI (2018)

Assumption about the normality of disturbances (MLR.6) is a must requirement for the linear regression model free of heteroscedasticity. By the central limit theorem, no matter what distribution things have, the sampling distribution tends to be normal, if the sample is big enough (n>30). Since our sample size is definitely large enough, we use the visual method of q-q plot that draws the correlation between the sample of artworks and the normal distribution. The better residuals copy the dotted line in Figure 4.5 the better in terms of normality the distribution appears. Relying on the graphical analysis, we take the data to be normally distributed.

Figure 4.5 NORMAL DISTRIBUTION OF RESIDUALS



Source: Author's own computation using BASI (2018)

In summary, each of the MLR assumptions has its own meaning in creating a valid model. MLR.1 – MLR.4 have to be satisfied in order to guarantee the unbiasedness of OSL. MLR.5, apart from its use for deriving variance formulas, is applied to prove that OLS is the best linear unbiased estimator. Finally, MLR.6 is used to arrive at exact sampling distributions of t and F statistics (Wooldridge, 2003).

4.4 Interpretation of Results of Empirical Analysis

The reference group of artworks consists of works on paper by Gustav Klimt, which were sold between 1995-2004 in less important auction houses (under Auction House class 1) in locations with little artistic influence (under Location of auction class 1). There was no "natural" reference group but it was important to keep enough artworks hidden in the reference group, and hence the selection was shortened to artists with sizable oeuvre. Gustav Klimt is the 5th highest productive author in our data set with

617 artworks. Consequently, we wanted the reference group to include the least important auction houses and locations of little artistic influence to be included. Thus, auction houses of class 1 as well as locations of class 1 were chosen. Since works on paper are represented abundantly in the lower spectrum of prices, the choice was in this sense natural. The coefficients on dummy variables in Table 4.2 should be interpreted as a percentage change in the price in USD[16] (the sale price will be changed by $100\beta_i\%$) in comparison to the reference group, other things being equal.

[16] Adjusted for inflation with the base in 2018

Table 4.2 Estimation Results of Regression Model

OLS Regression: Log(RealPrice)

Explanatory Variables	**Coefficient**	**(Std. Err.)**
Intercept	9.967 ***	(< 2e-16)
Alexander Calder	-0.169 **	(0.006)
Alfred Sisley	1.027 **	(< 2e-16)
Aplhonse Mucha	-1.660 ***	(< 2e-16)
Amedeo Modigliani	0.938 ***	(< 2e-16)
Camille Pissarro	1.106 ***	(< 2e-16)
Claude Monet	2.070 ***	(< 2e-16)
Edgar Degas	1.642 ***	(< 2e-16)
Edvard Munch	0.547***	(1.36e-06)
Egon Schiele	1.489***	(< 2e-16)
Frank Kupka	-1.109***	(< 2e-16)
Georges Braque	-0.109	(0.155)
Gustave Courbet	-1.256***	(< 2e-16)
Henri Matisse	1.395***	(< 2e-16)
Honore Daumier	-0.883***	(1.10e-13)
Joan Miro	1.198***	(< 2e-16)
Lucio Fontana	1.242***	(< 2e-16)
Marc Chagall	1.287***	(< 2e-16)
Marcel Duchamp	0.104	(0.510)
Oskar Kokoschka	-0.681***	(< 2e-16)
Pablo Picasso	2.478***	(< 2e-16)
Paul Cezanne	1.080***	(< 2e-16)
Paul Gauguin	0.601***	(3.37e-12)
Paul Signac	0.038	(0.575)
Pierre Bonnard	0.293***	(0.000)
Pierre-Auguste Renoir	1.274***	(< 2e-16)
Piet Mondrian	0.831***	(1.67e-11)
Thomas Cole	-2.022***	(< 2e-16)
Vincent van Gogh	2.049***	(< 2e-16)
Notable Art Locations (class 3)	0.795***	(< 2e-16)
Established Art Locations(class 2)	0.300***	(4.12e-09)
Christie's (class 4)	0.279***	(1.16e-07)
Sotheby's (class 3)	0.358***	(1.45e-11)
Auction House (class 2)	-0.101*	(0.043)
Years (2004, 2007]	0.325***	(< 2e-16)
Years (2007, 2008]	0.558***	(< 2e-16)
Years (2008, 2009]	0.328***	(2.48e-09)
Years (2009, 2010]	0.445***	(< 2e-16)
Years (2010, 2013]	0.443***	(< 2e-16)
Years (2013, 2016]	0.881***	(< 2e-16)
Years (2016, 2018]	1.919***	(< 2e-16)
Paintings	1.522***	(< 2e-16)
Photographs	-0.393	(0.129)
Adjusted R-squared	0.659	

. p < 0.10, * p < 0.05, ** p < 0.01, *** p < 0.001

Source: Author's own computations using BASI (2018)

Most of the dummy variables in our model are highly significant, except for the photographs dummy variable and some authors. In terms of auction houses and location of auctions all dummy variables are significant at least at 5% level. This confirms that the reference group as set includes relatively low prices in comparison to the rest of auction houses and remaining locations. To be more precise, it includes relatively cheap artworks, which may not as a result be interesting for well-established auction houses.

Auction Houses

The presence of Auction House variable in this paper is of crucial importance. Coefficients on Sotheby's (0.358) and Christie's (0.279) show that these auction houses have considerable power in affecting the sale price, e.g. if the artwork is sold in Sotheby's the sale price will on average increase by 36% in comparison to the reference group, other things being equal. Thus, if the consignor decides to sell the artwork in Christie's or Sotheby's, the markup will be significant. With branches all over the world it is much easier for these auction houses to dominate the art market. Not only these market leaders have much wider clientele but due to their established media presence, more buyers are able to monitor the current offers. Interestingly, other well-established auction houses do not have high explanatory power in predicting the sale price, and show on average 10% decrease in the sale price in comparison to small auction houses hidden in the reference group. To this end, our 2nd hypothesis about Christie's and Sotheby's having significant power in increasing the value, and hence the sale price of auctioned art pieces cannot be rejected.

Location of Auction

Significant role plays the location of the auction. All location dummy variables in our model proved significant. This is to say, location of the auction influences the sale price substantially. Although, there is no measure that evaluates the location quality, this paper assumes that consignors might prefer certain towns according to their art importance. As assumed less dynamic art centers with established art institutions

(under class 2) show on average 30% increase in sale price with reference to locations with little artistic influence. Further, notable art centers (under class 3) are responsible for almost 80% increase in sale price in comparison to the reference group. These results suggest that London, New York and Hong Kong have a strong positive effect on formation of the sale price, and hence our 1st hypothesis is not rejected. It is good to point out that consumers are likely to decide based on recommendations, and personal opinion, therefore endogeneity might be present.

Auction Date

The dummies for auction date included in the regression, which account for art market changes, all proved significant at 0.1%. The reference group includes the period between the years 1995-2004 that is characteristic for its steady and not very fast growth. Keeping the reference group in mind, our regression results nicely support our assumptions. Not surprisingly, the year 2007 shows a strong increase in the sale price followed by a sudden decrease during the period of financial crisis. Although, the price estimates during the period of financial crises were more precise and reasonable, they still seem to be considerably higher than those achieved between the years 1995-2004. We could presume that the inflation in the art sales was much higher than the implicit inflation we eliminated in the prices of our samples. Nevertheless, the sale prices quickly recovered and have exceeded the pre-crisis levels. The highest coefficient of 1.919 for the auction period between the years 2016-2018, characteristic for its sudden upsurge in auction prices, suggests that prices have on average doubled for this period in comparison to the reference group.

Category of Artworks

The category of Artworks should be discussed in detail. The reference group includes Works on Paper, remaining classes of Photographs and Paintings are being included in the model. The most frequent group in the dataset is Paintings with 5,768 art pieces, strictly followed by Works on paper with 5,672 artworks. Number of observations for

Photographs is significantly lower than for the remaining two categories. Works on paper by their nature represent the less expensive pieces sold at auctions as they require less effort in the production process. They usually refer to drawings but might as well cover sketches by famous artists. Paintings are frequently worked-out using various techniques and manually created paint with pigments. This is also reflected in the higher sale price on average by 50% for paintings in comparison to the works on paper. Thus, artwork's price also accounts for the difficulty in the production process. The mark up for paintings should be especially pronounced with the Blue Chip artists. Photographs, on the contrary, require more time spent with advanced technology; copies might be produced. If there are more than 10 publicly available copies, the drop in price should be significant (Gerlis, 2014). The results are not surprising at all as they indicate lower sale price on average by 39% for Photographs in comparison to the works on paper. The coefficient on photographs, however, is not significant. Yet, the dummy variable for this category has to be kept in the model, otherwise the interpretation of the significant dummy variable would not be clear.

Artists

Prospective buyers are deciding about the purchase of a particular artwork based on its quality. Artists, in general, work as the best approximation of quality of any artwork. Each author has a unique style that attracts distinct clientele. In our model, most of dummy variables for artists proved significant, except for Georges Braque, Marcel Duchamp, and Pole Signac. Keeping in mind the reference group of artworks by Gustav Klimt, significantly more appreciated in price are art pieces by Claude Monet, Pablo Picasso and Vincent Van Gogh, in line with our assumptions. The highest coefficient in positive direction of 2.48 can be attributed to Pablo Picasso. In other words, if an artwork by Pablo Picasso is sold, its price will likely be more than twice as high as the price of any artwork from the reference group. Negatively appreciated authors are Thomas Cole, Oskar Kokoschka, Honore Daumier, Gustave Courbet, Georges Braque, Frank Kupka, Alphonse Mucha and Alexander Calder. Especially poorly appreciated are works by Thomas Cole, who has the lowest coefficient in negative direction. These results are in line with realized prices for artworks.

Low & High Estimates

It seems to be necessary to stress out the importance of expert estimates in determining the sale price. First of all, to avoid the violation of multicollinearity assumption we have decided to work predominantly with the low estimate, since the high estimate represents just an x-multiple of the low estimate (x being a constant factor). Secondly, while including low estimate in the regression model it helped us to demonstrate its fundamental role in value creation of artworks. Accordingly, it acts as a benchmark that is consequently only lightly improved by the remaining set of dummy variable. Further, the model suggests that the dummy variables on auction date and location of auction play a significant role in determining the sale price. Unfortunately, the coefficients on dummy variables as set by this model do not appear to have much explanatory power. Finally, since our aim was to find objective determinants of the sale price, low estimate was due to its fundamental connection to the sale price excluded from the final regression model.

Year of Creation

We assumed that older artworks should be sold for more than the more recent ones with a significant difference in price. The estimation of the model leads to an interesting result as the variable for the Year of Creation was rejected as a factor determining the sale price. Most of the dummy variables for years of creation did not prove significant and the variable, according to ANOVA, did not appear to play much role in the analysis. Insignificance of these dummy variables suggests that there is no difference between older and younger art pieces in terms of the sale price. Society often assumes that more recent art pieces are worth less than older and more proven artworks, however, the art world seems to abandon such a prejudice. Alternatively, year of creation might be important for determining period in author's life when the artwork was created. It should hold that art pieces produced at certain periods of artist's life are highly appreciated than others.

Signature

The importance of signature as a proof of authenticity did not show any significance in determining the sale price. For this reason, signature was omitted from the final model as a factor creating the sale price. Consequently, our 3rd hypothesis about signed art works achieving better appreciation in the sale price than art pieces with missing signature has been rejected. Society often assumes that signed works provide a statement of authenticity, yet the art world does not seem to adhere to such classification. Presumably provenance and exhibiting in public galleries play incomparably more important role in terms of authenticity.

In summary, each variable affects the sale price in a different manner. Our regression analysis showed that among the Blue Chip artists there are many whose sale price on average exceeds the prices achieved by Gust Klimt's artworks at auctions. It was also confirmed that the sale price is to a great extent sensitive to changes in location and auction house. Prestige of Christie's and Sotheby's seems to strongly affect the price appreciation. Equally, notable art locations are responsible for a huge increase in the sale price in comparison to locations with little influence on the art market, therefore, it might be wise to put in afford while deciding on the place of auction. Last of all, auction date significantly affects the sale price of artworks. This suggest that economic conditions exert strong power over auction market and guide the decisions of buyers.

4.5 Extensions of Empirical Analysis

We believe that further optimization of price determinants and more complex models could lead to improvements in prediction accuracy. Thus, the empirical part of this thesis could be enhanced by the following:

Firstly, online data bases account for millions of records in terms of artworks sold at auctions. By enlarging our data set to several hundreds of thousands of observations we might be able to judge the behavior in the art market more accurately.

Secondly, more precise work with inflation would be desirable. To source the information directly from the arts sector, or alternatively, from the real estate sector

might lead to more accurate adjustment of nominal prices. However, in our case, it was not possible to obtain the deflators from any of these two sectors.

Finally, the prediction ability of our model could be further improved by including more explanatory variables, e.g. information on the size of artwork and the lot sequence, and by expanding the categories of artworks (accounting for prints). Including artworks by living artists in our data set might as well increase its prediction power. Experimentation with interaction terms, especially on artists and different categories of artworks could further improve the model performance.

Chapter 5

CONCLUSION

"Binswager also connected economy and art in a novel way. Art, he points out, is based on imagination and is part of the economy."

(Obrist, 2014, p.23-24)

Art is a creation that requires time and efforts – but more life-efforts of discovery and originality than the production efforts. Growing demand of society for spiritual culture is favorable to the art market that demonstrates a level of maturity well matching with other alternative investment asset classes, i.e. gold and wine. The potential of art to act as a store of value significantly affects its status as an alternative investment. Art products are demanded as new investment options, which demonstrate little correlation to traditional financial assets, and hence might be used as a hedge against inflation.

Consequently, the heterogeneity of art market commodities makes the valuation extremely difficult. It would be ideal to analyze the art market using the same parameters as for the stock markets, however, unlike traditional asset classes, art does not adhere to any rigorous regulatory structures. Akin to private equity markets, art market is illiquid, demonstrates little transparency and is only lightly regulated. These similarities suggest that the traditional features of the art market, especially information asymmetry, do not necessarily hinder economic growth of art as an asset class.

Undoubtedly, both, investment and speculation are attracted to anything that promises above the average returns. The prices in the art market are predominantly dictated by speculations. Fake art piece by Picasso has the same aesthetical value as the original work of art, yet its price is million times lower. Thus, by far the crucial issue in the art market is not information asymmetry but rather valuation of artworks. Asset's worth that should subsequently translate to its sale price is extremely difficult to obtain.

In this thesis, by employing auction results of 29 Blue Chip artists, we examine the fundamental factors influencing the auction results in objects of visual art, whose value

is independent of the direct costs of production. We evaluate different model specifications, which results in threefold contributions of our thesis. Firstly, we offer a clearer explanation of the relationship of low and high estimates. Secondly, this thesis assesses the subsequent relationship of estimates to the sale price that includes buyer's premium. We find that estimates as set by the experts are the fundamental factors affecting the sale price. Thirdly, we utilize all significant features found in the literature on the topic of price determinants in art, which allows us to uncover objective factors determining the sale price of artworks.

Empirical analysis gives the following answers to our three hypotheses. Firstly, our analysis shows that in terms of location London, New York and Hong Kong are responsible for a great increase in price, on average by 80% with respect to locations with little artistic influence. Therefore, the hypothesis about notable art centers having positive effect on formation of the sale price could not be rejected. Consequently, we turn our attention to importance of auction houses in determining the sale price. Our model allows us to test the hypothesis that having the artwork auctioned in Sotheby's or Christie's leads to an increase in the sale price. This hypothesis was not rejected because Sotheby's showed on average 36% increase and Christie's 28% increase in the sale price in comparison to the reference group. Finally, we conclude that the signature does not play much role in determining the sale price and the hypothesis about signed artworks achieving better price appreciation than art pieces with missing signature was rejected because no significant difference between the two groups has been found.

The unique nature of the art market makes any kind of forecasting very difficult. Due to the absence of unifying language, the quality of artworks is increasingly judged by their price. We consider artists who sell for extreme sums as the benchmark of quality on the art market. In reality, it requires years of engagement with specific periods and artists to understand investment quality. While considering the price determinants of artworks, reputation of artists and location of auction together with prestige of auction houses have major impact on the sale price. Yet, there is the intangible factor of subjective human taste and the superb influence of expert estimates. Art that used to serve predominantly an aesthetic function, demonstrates evidence of technical abilities, which should encourage consumer confidence and appeal to broader professional base.

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Appendix A

Additional Tables

Table A.1 Auction results distribution with respect to the year of creation

	Year of Creation Classes	***Frequency***	***% of Total***
Older Art Movements	Before 1891	1760	15.4
Modern Art	Years 1891 – 1910	1682	14.7
	Years 1911 – 1930	2037	17.8
	Years 1931 – 1950	1269	11.1
	Years 1951 – 1970	1923	16.8
Contemporary Art	After 1970	681	5.9
Not Available		2112	18.3

Source: Author's own computations using BASI (2018)

Table A.2 Auction results distribution with respect to the artistic category

Artistic Category	***Frequency***	***% of Total***
Paintings	5768	50.31
Works on Paper	5672	49.48
Photographs	24	0.21

Source: Author's own computations using BASI (2018)

Table A.3 Auction results distribution with respect to the artist's name

Artist's Name	***Frequency***	***% of Total***
Alexander Calder	875	7.63
Alfred Sisley	273	2.38
Alphonse Mucha	155	1.35
Amedeo Modigliani	377	3.29
Camille Pissarro	448	3.91
Claude Monet	441	3.85
Edgar Degas	441	3.85
Edvard Munch	127	1.12
Egon Schiele	506	4.41
Frank Kupka	359	3.13
Georges Braque	398	3.47
Gustav Klimt	617	5.38
Gustave Courbet	321	2.80
Henri Matisse	591	5.16
Honore Daumier	108	0.94
Joan Miro	630	5.50
Lucio Fontana	765	6.67
Marc Chagall	604	5.27
Marcel Duchamp	70	0.61
Oskar Kokoschka	340	2.97
Pablo Picasso	693	6.05
Paul Cezanne	336	2.93
Paul Gauguin	251	2.19
Paul Signac	534	4.66
Pierre Bonnard	443	3.86
Pierre-Auguste Renoir	517	4.51
Piet Mondrian	103	0.90
Thomas Cole	28	0.24
Vincent van Gogh	113	0.99

Source: Author's own computations using BASI (2018)

Table A.4 Auction results distribution with respect to the town and auction house

Location of Auction House

Auction House	***1***	***2***	***3***	***Total***
1	501	864	9	1374
2	127	562	248	937
3	121	156	4109	4386
4	55	314	4398	4767
Total	804	1896	8764	11464

Source: Author's own computations using BASI (2018)

Table A.5 Results of Analysis of Variance (ANOVA) of the regression model

Analysis of Variances: Log(RealPrice)

	F-value	**P-value**
Artist's Name	599.821	< 2.2e-16 ***
Location of Auction	638.340	< 2.2e-16 ***
Auction House	45.572	< 2.2e-16 ***
Auction Date	156.958	< 2.2e-16 ***
Category	1455.575	4.392e-07 ***

. p < 0.10, * p < 0.05, ** p < 0.01, *** p < 0.001

Source: Author's own computations using BASI (2018)